DERWENT-ACC-NO: 1993-348556

DERWENT-WEEK: 199344

TITLE: Electroconductive resin part for moulding tools and heat resistant parts - comprises aluminium@ alloy powder, metal esp. copper@ or alloy powder with low specific electric resistance, and synthetic e.g. thermosetting epoxy! resin

PRIORITY-DATA: 1992JP-0053221 (March 12, 1992)

PATENT-FAMILY:

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INT-CL (IPC): B29C033/38, C08J005/00

ABSTRACTED-PUB-NO: JP 05255517A

BASIC-ABSTRACT:

The part comprises (A) 25-60 wt.% of an aluminium alloy powder, (B) 15-60 wt.% of a metal (alloy) powder with a specific electric resistance of less than 100 micro ohm cm, and (C) 15-5 wt.% of a synthetic resin.

The metal powder is pref. copper powder. The synthetic resin has a heat resistance of more than 200deg.C. The resin part has a density of less than 4.

The aluminium alloy powder is, e.g. an aluminium alloy atomised powder (AAP-1) comprising 83.5 wt.% of Al, 12 wt.% of Si, and 4.5 wt.% of Cu and having a particle dia. of less than 63 micron. The copper powder has a particle dia. of less than 63 micron and a specific electric resistance of 1.7 micro ohm cm. The synthetic resin is, e.g. a thermosetting epoxy resin.

USE/ADVANTAGE - The resin part is used for moulding tools and structural parts. It has a high electroconductivity, heat resistance, and thermoconductivity, and a low thermal expansibility.

In an example, a resin compsn. comprising 65 wt.% of AAP-1, 15 wt.% of the copper powder, and 25 wt.% of a thermosetting epoxy resin was fed in a mould, hot-pressed under 50 kg/cm2 at 200deg.C, and cured at 200deg.C for 3 hrs. to give a resin part. The resin part had a coefft. of linear thermal expansion of 10power-6, a thermoconductivity of 0.011 cal/cm.s deg.C, a density of 2.2 g/cm3, and an electric resistance of less than 50 ohm/cm.

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Basic Abstract Text - ABTX (3):

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Basic Abstract Text - ABTX (5):

In an example, a resin compsn. comprising 65 wt.% of AAP-1, 15 wt.% of the

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the suitable conductive resin Plastic solid for die manufacture in more detail about a conductive resin Plastic solid.
[0002] In this specification, that it is with "%" and the "section" shall mean "weight %" and the "weight section", respectively.
[0003]
[Description of the Prior Art] Two or more "sister products" with which differentiation thru/or individualization of goods comes to be further called for, for example, only color tones differ also in the same goods are manufactured recently, and many optional accessories are also manufactured. Moreover, since it conforms to consumer needs, the life cycle of goods is also becoming short. Also in the components, for example, plastic-molding components, used by goods for the bottom of such a situation, the inclination of the formation of small quantity many forms is being promoted. Moreover, the prototype for the model change of a new product development or the existing product has also come to be performed more frequently. Therefore, in order to produce plastic-goods-molding components commercially quickly, a simple die is spreading.
[0004] A plastic pattern is in one of the simple dice which have spread most now. On the occasion of manufacture of this plastic pattern, liquefied resin composite which mixed the powder of metals, such as iron, copper, and aluminum, or an alloy to the epoxy resin of the room-temperature-setting mold by 2 liquid mixing is usually used as a raw material, and it slushes into the master model fixed in the framework, i.e., the model of a configuration to create. Under the present circumstances, in order to remove the air involved in the interior, after performing a vacuum deairing, it is made to harden, a master model is sampled and a mold is produced by imprint. On the occasion of manufacture of a plastic pattern, grinding is not usually performed. This is because thermal resistance, rigidity, and reinforcement are low, so the epoxy resin of the room-temperature-setting mold by 2 liquid mixing has a possibility that it may heat-deform and a plastic pattern may be damaged by machining.
[0005] Moreover, since the thermal resistance of the epoxy resin itself to be used is low, the plastic pattern manufactured by imprint also lacks in thermal resistance and endurance. Therefore, the count which can be cast is restricted although this is usable once as molds for injection molding, such as the resin which can be fabricated at comparatively low temperature, for example, ABS, polyethylene, and a vinyl chloride.
[0006] JP,1-278567,A has proposed using the combination of the resin and metal powder excellent in thermal resistance, i.e., a heat-curing mold epoxy resin etc., and an aluminium powder. Manufacture of the die from this ingredient is performed by the heating compression-molding approach. That is, die materials are slushed into the master model fixed in the framework, and a die is manufactured by carrying out heating pressurization. Under the present circumstances, in using the resin which gas generates, it is in the middle of shaping, and does not generate a void inside a plastic pattern by reducing a pressure and performing "gas drainage."

[0007] Generally, when manufacturing a plastic pattern by imprint from a master model, the direct manufacture of the mold of the configuration of arbitration cannot necessarily be carried out, and when an undercut is in a master model, or when a configuration is complicated, it is necessary to perform grinding of the mold by machining as post processing after an imprint. Rigidity, reinforcement of the plastic pattern indicated by above-mentioned JP,1-278567,A, etc. improve remarkably, and it is the point that grinding by machining can be easily performed now, and is excellent with concomitant use with heat resistant resin and aluminium alloy powder. However, post processing by electric means, such as an electron discharge method which has spread quickly now with the outstanding properties, such as the high workability, short floor to floor time, and high process tolerance, is impossible. This is because the conductivity of the plastic pattern as a work material is low. That is, it is because this plastic pattern has the oxide film which is an insulating material with the stable amorphous phase which has the ductility containing water of crystallization in a front face since the aluminum to be used is the powder made to solidify by quenching, although the aluminum which is originally a quantity conductivity metal is contained, so conductivity is low. Moreover, generally the above-mentioned mold with which resin consists of composite of such an aluminium powder and resin since conductivity is lower than a metal does not show the outstanding conductivity required to perform an electron discharge method.
[0008] It is impossible to perform an electron discharge method for the same reason also in the case of the mold made from composite which consists of mixture with the epoxy resin of a room-temperature-setting mold, metal, or alloy powder by the above-mentioned 2 liquid mixing.
[0009]
[Problem(s) to be Solved by the Invention] Therefore, this invention sets it as the main purposes to offer the plastic pattern excellent in conductivity which can perform post processing by the electron discharge method.
[0010]
[Means for Solving the Problem] this invention person found out that the product which has high conductivity in extent whose electron discharge method becomes possible was obtained, when a specific resistance value blended further the powder of the metal which is 100 or less microomegacm, or its alloy with that the resin Plastic solid containing aluminium alloy powder is advantageous in respect of material properties, such as reinforcement, rigidity, and lightweight nature, as a result of repeating research wholeheartedly in view of the present condition of the above techniques, and such a resin Plastic solid. Furthermore, such a resin Plastic solid was lightweight and it is not only useful as a die, but found out that it was useful also as a structural part with which conductivity is demanded.
[0011] Namely, 15 - 60% per sort [at least] (however, aluminium alloy powder is removed) of powder of 25 - 60% of conductive resin Plastic solid:A; aluminium alloy powder which consists of A, B, and C component which show this invention to the :1. following which is what offers the following conductive resin Plastic solid (it may be called a resin Plastic solid below), the metal of 100 or less microomegacm of B; specific resistance values, and its alloy and C; it is 15 - 25% of synthetic resin.
[0012] 2. Conductive resin Plastic solid given in above-mentioned term 1 whose B component is copper powder.
[0013] 3. Conductive resin Plastic solid given in above-mentioned term 1 whose C component is synthetic resin which has thermal resistance of 200 degrees C or more.
[0014] 4. Conductive resin Plastic solid given in above-mentioned term 1 whose specific gravity of Plastic solid is four or less.
[0015] Although it hardly contributes to conductivity as mentioned above, the aluminium alloy powder used as an A component in this invention has lightweight itself, since it has the outstanding physical properties, such as high intensity and high rigidity, lightweight-izes a resin Plastic solid and improves the physical properties. As such an aluminium alloy, aluminum-Si, aluminum-Si-Cu, aluminum-Si-nickel, aluminum-Fe, etc. are illustrated. The particle size of aluminium alloy powder is usually below 100 meshes (150 micrometers), and is below 250 meshes (63 micrometers) more preferably. When the particle size of aluminium alloy powder is too large, in order that aluminium alloy powder may not distribute to homogeneity in a molding body, aluminium alloy powder projects to the field which the

reinforcement of a Plastic solid fell and machined, and smooth nature may not be obtained.
[0016] The metal component used as a B component in this invention is at least one sort (however, aluminium alloy powder is removed) of the powder of the metal of 100 or less microomegacm of specific resistance values, and its alloy. B component also demonstrates the effectiveness of controlling the thermal expansion while improving the conductivity and thermal conductivity of a resin Plastic solid. When a specific resistance value exceeds 100microomegacm, it is hard coming to give sufficient conductivity for a resin Plastic solid. Especially as such a metal component, although not limited, alloys, such as metals, such as copper, iron, nickel, and titanium, and brass (Cu-Zn), nickel silver (Cu-nickel-Zn), a manganin (Cu-Mn-nickel), and stainless steel, etc. are illustrated. In these, since copper is excellent in conductivity and thermal conductivity, it is the most desirable. The particle size of metal component powder is usually below 100 meshes (150 micrometers), and is below 250 meshes (63-mum) more preferably. When the particle size of copper powder is too large, the same problem as the case of the above-mentioned aluminium alloy is produced.
[0017] Even if it faces the injection molding and compression molding which are performed at about 200 degrees C, in order that a die may demonstrate sufficient reinforcement, rigidity, a degree of hardness, etc., as for the synthetic resin used as a C component in this invention, it is desirable to have the endurance of 200 degrees C or more. As such resin, thermoplastics, such as thermoplastics, such as polyether sulphone resin, polyetherimide resin, and polyamidoimide resin, and polyimide resin, a thermosetting epoxy resin, and phenol resin, etc. is illustrated.
[0018] this invention resin molding object is the rate of 25 - 60% of A components, 15 - 60% of B components, and 15 - 25% of C components, and is constituted that the specific gravity is four or less. Since there is the blending ratio of coal of each component in relation to mutual and the physical properties of a resin Plastic solid are influenced, it will be as follows to explain the reason for limitation of each component according to an individual, if a temporary reason is shown, although it is not necessarily appropriate.
[0019] when there are too few amounts of A component, the reinforcement of a resin Plastic solid, rigidity, etc. are inadequate -- becoming -- and -- the -- lightweight -- voltinism is not attained, either. Since the amount of other components decreases relatively when there are too many amounts of A component, the engine performance of the request originating in other components is not obtained.
[0020] Since the amount of other components decreases relatively to the conductivity of a plastic pattern becoming low when there are too few amounts of B component when there are too many amounts of B component, the engine performance of the request which originates in other components too is not obtained. Moreover, if there are too many amounts of B component, the specific gravity of a resin Plastic solid becomes larger than 4, handling [mold / of a large-scale method] will become difficult, and the lightweight nature which is one of the greatest advantages of a resin Plastic solid will be spoiled.

[0021] When there are too few amounts of C component, the amount of resin becomes inadequate, an opening is produced, and a dense resin Plastic solid is not acquired, but a strong fall is caused. On the other hand, when there are too many amounts of C component, while conductivity falls, other properties, such as good thermal conductivity for which a die is asked, and high intensity, fall. Especially a thermally conductive fall brings about long period of time-ization of a molding cycle on the occasion of injection molding, and checks productivity. If a molding cycle is shortened, an accumulation phenomenon will be produced in a die and the fall of the mold accompanying a temperature rise on the strength, as a result breakage of a mold will be produced.
[0022] The resin Plastic solid by this invention can be acquired by fabricating the raw material which consists of A, B, and a C component according to a conventional method. That is, A, B, and C component are mixed to homogeneity with a blender etc. at a predetermined rate, as it is the above, it presses into the bottom of heating and a Plastic solid is acquired. Subsequently, machining including an electron discharge method is performed and a predetermined die is obtained.
[0023]
[Effect of the Invention] The resin Plastic solid by this invention had conductivity with good extent

which can perform an electron discharge method, was excellent in thermal resistance, and its thermal conductivity is high and it is equipped with the property that thermal-expansion nature is low. Therefore, it is lightweight and it is not only useful as a die material, but can use it as various kinds of structural parts of which conductivity is required.

[0024]

[Example] An example is shown below and the place by which it is characterized [of this invention] is clarified further.

[0025] Each raw material which contains A, B, and C component at a rate (% of the weight) shown in example 1 table 1 was used, and the resin Plastic solid was manufactured.

[0026]

[Table 1]

		A 成分		B 成分				C 成分		
		アルミニウム合金	アルミニウム	銅	鉄	SUS316L	洋銀4種	熱硬化性エポキシ樹脂	2液混合エポキシ樹脂	ポリエーテルサルホン
実施例	1	60		15				25		
	2	25		50	10			15		
	3	40				40		20		
	4	50					30	20		
	5	40		40						20
比較例	1	70			5			25		
	2	60		35				5		
	3	35			20	10		35		
	4	15		50			20	15		
	5	73						27		
	6		70						30	

[0027] The detail of A, B, and C component is as follows.

[0028] A component aluminium alloy powder -- Below aluminum-12Si-4.5 the atomization powder of Cu and 250 meshes (63 micrometers) of particle size

[0029] Aluminium powder -- The atomization powder of 99.3% or more of purity, and 250 meshes (63 micrometers) of below particle size

[0030] B component copper powder -- The powder of 99.5% or more of purity, 250 meshes (63 micrometers) of below particle size, specific resistance value =1.7microomegacm.
[0031] SUS316L Powder -- Atomization powder, 250 meshes (63 micrometers) of below particle size, specific resistance value =80microomegacm.
[0032] 4 sorts of nickel silver powder -- Atomization powder and 250 meshes (63 micrometers) of below particle size
[0033] The end of iron powder -- The atomization powder of 99.0% or more of purity, 250 meshes (63 micrometers) of below particle size, specific resistance value =9.8microomegacm.
[0034] C component thermosetting epoxy resin -- A trademark "best REXX LS", polyether sulphone resin by Sumitomo Chemical Co., Ltd. -- Trademark "VICTREX", 2 liquid hybrid model epoxy resin epoxy resin by Sumitomo Chemical Co., Ltd. -- Trademark "T-301 / R-4", Ciba-Geigy Japan curing agent -- in using a thermosetting epoxy resin as T-301/a trademark "H-4" C component Pressure of 50kg/cm2 after mixing the raw material compound containing A, B, and C component to homogeneity with V blender and carrying out specified quantity restoration into a metal flask The temperature up was carried out to the temperature of 200 degrees C, pressurization compression molding was carried out, subsequently curing was carried out at 200 degrees C for 3 hours, and the resin Plastic solid was acquired.
[0035] When polyether sulphone resin was used as a C component, the resin Plastic solid was acquired like the case where a thermosetting epoxy resin is used.
[0036] When 2 liquid hybrid model epoxy resin is used as a C component, after mixing the epoxy resin and curing agent containing an aluminium powder to homogeneity, the vacuum deairing was slushed and carried out within the limit, precure was performed at 50 degrees C for 8 hours, subsequently curing was carried out at 180 degrees C for 20 hours, and the resin Plastic solid was acquired.
[0037] Various kinds of characteristic tests which show the resin Plastic solid acquired as mentioned above in Table 2 were presented.
[0038]
[Table 2]

		特性					
		抗折力 kg/mm²	熱膨張係数 ×10⁻⁶ *1	熱伝導度 cal/cm・℃	成形体密度 g/cm³	抵抗値 Ω *2	放電加工性 *3
実施例	1	22.5	33	0.011	2.2	50>	○
	2	20.8	26	0.032	3.5	1>	◎
	3	22.2	31	0.010	2.7	200>	○
	4	21.8	32	0.025	2.5	150>	○
	5	19.6	32	0.019	2.9	5>	◎
比較例	1	22.2	33	0.013	2.1	10000>	▲
	2	5.1	39	0.010	1.5	10>	○
	3	15.0	40	0.006	2.7	30000>	▲
	4	20.5	28	0.027	4.1	1>	◎
	5	22.4	34	0.010	2.1	∞	×
	6	12.0	35	0.009	2.0	∞	×

*1：25℃～150℃
*2 テスター計測（電極間距離1cm）；日置電機㈱製ハイテスタを使用
*3 優◎>○>>▲>×劣
放電加工条件 ピーク電流； 5A
時 間；150μs
休止時間； 50μs
無負荷電圧；100V

[0039] The resin organizer in which an electron discharge method is possible was obtained without preventing properties, such as reinforcement for which a die is asked by blending the powder of the metal which has the conductivity more than fixed as a B component, or its alloy, dimensional stability, and thermal conductivity, from the result shown in Table 2. When using copper powder as a B component especially, the result of having excelled extremely synthetically is obtained in conductivity, dimensional stability, thermal conductivity, electron discharge method nature, etc.

[Translation done.]